

Lampiran 1 Foto spesimen hasil Gas Nitriding

Tanpa Perlakuan



Holding Time 1 jam



Holding Time 2 jam



Holding Time 3 jam



Holding Time 4 jam



Holding Time 5 jam



Lampiran 2 Sertifikat bahan dan komposisi Al-Mg-Si 6061

FROM : FAX NO. : Oct. 30 2012 09:58AM P

KUM-04

INSPECTION CERTIFICATE No 11.9585

EN 10204 - 3.1




Consigner:		Quantity: 29								
Consignee:		Net Weight, kg.: 1422								
Contract number: V1283-S	Specification No: V1283									
PO-KL M-01/170111 part 1	Lot No: 1									
Article number:	Package No: 715210									
Description of Goods: Sheet:		Requirements on the Product:								
Grade of Product:	Dimensions, inch/mm	Material conforms to quality of alloy: 6061 T651								
	6.000X1216.2X2438.4	Product conforms to all requirements of: ASTM B208-07 This product conforms to European Union RoHS Directive 2002/95/EC								
Mechanical Properties										
The Condition of Tested Standards	Lot Number	Cast Number	Number of Tests	Tensile Strength		Yield Strength (0.2% offset)		Elongation, %		Hardness HB
				ksi	ksi	ksi	ksi	min	max	
Required				min	max	min	max	min	max	
	070190	13-6158	5	48.2	48.7	41.0	42.5	12.0	14.0	
Chemical Composition, %										
Element	Silicon Si	Iron Fe	Copper Cu	Manganese Mn	Magnesium Mg	Chromium Cr	Nickel Ni	Zinc Zn	Titanium Ti	Zirconium Zr
Required	0.4-0.8	0.7	0.10-0.40	0.15	0.8-1.2	0.04-0.35	-	0.25	0.15	-
Contents	0.88	0.22	0.21	0.08	1.01	0.06	-	0.08	0.08	-
Element	Ti+Zr	Al	Sn	Bismuth Bi	Plumbum Pb	Vn+Cr	Cu	Other Elements		Al
Required	-	-	-	-	-	-	-	Each	Total	remainder
Contents	-	-	-	-	-	-	-	0.06	0.15	remainder
								0.06	0.15	remainder
Other Tests										
Method	Macro-structure	Micro-structure	ISI	Electro-conductivity	SCF	Contents H2 of metals cm3/100gr				
Result										

Lampiran 3 Sertifikat hasil pengujian kekerasan permukaan



INSTITUT TEKNOLOGI NASIONAL MALANG
FAKULTAS TEKNOLOGI INDUSTRI JURUSAN TEKNIK MESIN
LABORATORIUM PENGUJIAN MATERIAL
Jl. Raya Karanglo Km. 2 Telp. (0341) 417636 Ext. 511 Malang

DATA HASIL PENGUJIAN KEKERASAN

Nama : Indrawan Wibisono
NIM/Jurusan : 105060207111012
Perguruan Tinggi : Universitas Brawijaya Malang
Hari / Tanggal : Jumat / 28 Nopember 2014
Specimen : Al-Mg-Si (Seri 6016)

MICRO VICKERS HARDNESS TESTER

Code No : 810-100E
Serial No : 555186
Model : Mitutoyo MVK – E3 Akashi Corporation Japan
Timer : 10 Detik
Beban : 100 gf
Identor : Diamond 136 °

No	Perlakuan	Penitik	Diameter 1 (μm)	Diameter 2 (μm)	Diameter Rata-Rata (μm)	HVN
1	Tanpa di perlakukan	1	205	202	203,5	133
		2	180	206	193	147
		3	195	197	196	143
2	Nitriding Pendingan Udara 1 Jam	1	309	301	305	59
		2	292	285	288,5	65,9
		3	307	297	302	60,2
3	Nitriding Pendingan Udara 2 Jam	1	301	289	295	63,1
		2	303	298	300,5	60,8
		3	311	290	300,5	60,8
4	Nitriding Pendingan Udara 3 Jam	1	230	228	229	105
		2	228	235	231,5	102
		3	227	231	229	105
5	Nitriding Pendingan Udara 4 Jam	1	212	202	207	128
		2	220	229	224,5	109
		3	210	225	217,5	117
6	Nitriding Pendingan Udara 5 Jam	1	311	315	313	56
		2	310	318	314	55,7
		3	313	320	316,5	54,7

Malang, 28 Nopember 2014
Kepala Laboratorium Uji Material

Ir. Teguh Rahardjo, MT
NIP. 195706011992021001

Lampiran 4 Tabel konversi kekerasan permukaan

Test load 0.9807N(0.100)

Vickers Hardness Number

a	0.0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5
55.0	1814	1782	1750	1719	1689	1660	1631	1604	1576	1550
60.0	1524	1499	1475	1451	1428	1405	1383	1361	1340	1319
65.0	1299	1279	1260	1241	1222	1204	1187	1170	1153	1136
70.0	1120	1104	1089	1073	1059	1044	1030	1016	1002	989
75.0	976	963	950	938	926	914	902	891	879	868
80.0	857	847	836	826	816	806	797	787	778	769
85.0	760	751	742	733	725	717	709	701	693	685
90.0	677	670	663	655	648	641	634	628	621	615
95.0	608	602	595	589	583	577	571	566	560	554
100.0	549	543	538	533	527	522	517	512	507	503
105.0	498	493	488	484	479	475	470	466	462	458
110.0	454	449	445	441	437	434	430	426	422	419
115.0	415	411	408	404	401	397	394	391	388	384
120.0	381	378	375	372	369	366	363	360	357	354
125.0	351	348	346	343	340	338	335	332	330	327
130.0	325	322	320	317	315	313	310	308	306	303
135.0	301	299	297	295	292	290	288	286	284	282
140.0	280	278	276	274	272	270	268	266	265	263
145.0	261	259	257	256	254	252	251	249	247	246
150.0	244	242	241	239	238	236	234	233	231	230
155.0	228	227	225	224	223	221	220	218	217	216
160.0	214	213	212	210	209	208	207	205	204	203
165.0	202	200	199	198	197	196	194	193	192	191
170.0	190	189	188	187	185	184	183	182	181	180
175.0	179	178	177	176	175	174	173	172	171	170
180.0	169	168	168	167	166	165	164	163	162	161
185.0	160	159	159	158	157	156	155	154	154	153
190.0	152	151	150	150	149	148	147	147	146	145
195.0	144	144	143	142	141	141	140	139	139	138
200.0	137	137	136	135	134	134	133	133	132	131
205.0	131	130	129	129	128	127	127	126	126	125
210.0	124	124	123	123	122	122	121	120	120	119
215.0	119	118	118	117	117	116	115	115	114	114
220.0	113	113	112	112	111	111	110	110	109	109
225.0	108	108	107	107	106	106	106	105	105	104
230.0	104	103	103	102	102	102	101	101	100	99.8
235.0	99.4	98.9	98.5	98.1	97.7	97.3	96.9	96.5	96.1	95.7
240.0	95.3	94.9	94.5	94.1	93.7	93.3	92.9	92.6	92.2	91.8
245.0	91.4	91.1	90.7	90.3	89.9	89.6	89.2	88.9	88.5	88.2
250.0	87.8	87.5	87.1	86.8	86.4	86.1	85.7	85.4	85.1	84.7
255.0	84.4	84.1	83.7	83.4	83.1	82.8	82.4	82.1	81.8	81.5
260.0	81.2	80.9	80.6	80.3	79.9	79.6	79.3	79.0	78.7	78.4
265.0	78.1	77.9	77.6	77.3	77.0	76.7	76.4	76.1	75.8	75.6
270.0	75.3	75.0	74.7	74.4	74.2	73.9	73.6	73.4	73.1	72.8
275.0	72.6	72.3	72.0	71.8	71.5	71.3	71.0	70.8	70.5	70.2

Test load 0.9807N(0.100)

Vickers Hardness Number

a	0.0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5
280.0	70.0	69.7	69.5	69.3	69.0	68.8	68.5	68.3	68.0	67.8
285.0	67.6	67.3	67.1	66.9	66.6	66.4	66.2	65.9	65.7	65.5
290.0	65.3	65.0	64.8	64.6	64.4	64.1	63.9	63.7	63.5	63.3
295.0	63.1	62.8	62.6	62.4	62.2	62.0	61.8	61.6	61.4	61.2
300.0	61.0	60.8	60.6	60.4	60.2	60.0	59.8	59.6	59.4	59.2
305.0	59.0	58.8	58.6	58.4	58.2	58.0	57.8	57.7	57.5	57.3
310.0	57.1	56.9	56.7	56.6	56.4	56.2	56.0	55.8	55.7	55.5
315.0	55.3	55.1	55.0	54.8	54.6	54.4	54.3	54.1	53.9	53.8
320.0	53.6	53.4	53.3	53.1	52.9	52.8	52.6	52.4	52.3	52.1
325.0	52.0	51.8	51.6	51.5	51.3	51.2	51.0	50.9	50.7	50.5
330.0	50.4	50.2	50.1	49.9	49.8	49.6	49.5	49.3	49.2	49.0
335.0	48.9	48.8	48.6	48.5	48.3	48.2	48.0	47.9	47.8	47.6
340.0	47.5	47.3	47.2	47.1	46.9	46.8	46.6	46.5	46.4	46.2
345.0	46.1	46.0	45.8	45.7	45.6	45.4	45.3	45.2	45.1	44.9
350.0	44.8	44.7	44.5	44.4	44.3	44.2	44.0	43.9	43.8	43.7
355.0	43.5	43.4	43.3	43.2	43.1	42.9	42.8	42.7	42.6	42.5
360.0	42.3	42.2	42.1	42.0	41.9	41.8	41.6	41.5	41.4	41.3
365.0	41.2	41.1	41.0	40.9	40.7	40.6	40.5	40.4	40.3	40.2
370.0	40.1	40.0	39.9	39.8	39.7	39.5	39.4	39.3	39.2	39.1
375.0	39.0	38.9	38.8	38.7	38.6	38.5	38.4	38.3	38.2	38.1
380.0	38.0	37.9	37.8	37.7	37.6	37.5	37.4	37.3	37.2	37.1
385.0	37.0	36.9	36.8	36.7	36.6	36.5	36.5	36.4	36.3	36.2
390.0	36.1	36.0	35.9	35.8	35.7	35.6	35.5	35.4	35.4	35.3
395.0	35.2	35.1	35.0	34.9	34.8	34.7	34.6	34.6	34.5	34.4
400.0	34.3	34.2	34.1	34.0	34.0	33.9	33.8	33.7	33.6	33.5
405.0	33.5	33.4	33.3	33.2	33.1	33.0	33.0	32.9	32.8	32.7
410.0	32.6	32.6	32.5	32.4	32.3	32.3	32.2	32.1	32.0	31.9
415.0	31.9	31.8	31.7	31.6	31.6	31.5	31.4	31.3	31.3	31.2
420.0	31.1	31.0	31.0	30.9	30.8	30.7	30.7	30.6	30.5	30.5
425.0	30.4	30.3	30.2	30.2	30.1	30.0	30.0	29.9	29.8	29.7
430.0	29.7	29.6	29.5	29.5	29.4	29.3	29.3	29.2	29.1	29.1
435.0	29.0	28.9	28.9	28.8	28.7	28.7	28.6	28.5	28.5	28.4
440.0	28.3	28.3	28.2	28.2	28.1	28.0	28.0	27.9	27.8	27.8
445.0	27.7	27.7	27.6	27.5	27.5	27.4	27.3	27.3	27.2	27.2
450.0	27.1	27.0	27.0	26.9	26.9	26.8	26.7	26.7	26.6	26.6
455.0	26.5	26.4	26.4	26.3	26.3	26.2	26.2	26.1	26.0	26.0
460.0	25.9	25.9	25.8	25.8	25.7	25.7	25.6	25.5	25.5	25.4
465.0	25.4	25.3	25.3	25.2	25.2	25.1	25.1	25.0	24.9	24.9
470.0	24.8	24.8	24.7	24.7	24.6	24.6	24.5	24.5	24.4	24.4
475.0	24.3	24.3	24.2	24.2	24.1	24.1	24.0	24.0	23.9	23.9
480.0	23.8	23.8	23.7	23.7	23.6	23.6	23.5	23.5	23.4	23.4
485.0	23.3	23.3	23.2	23.2	23.1	23.1	23.0	23.0	22.9	22.9
490.0	22.9	22.8	22.8	22.7	22.7	22.6	22.6	22.5	22.5	22.4
495.0	22.4	22.4	22.3	22.3	22.2	22.2	22.1	22.1	22.0	22.0
500.0	22.0	21.9	21.9	21.8	21.8	21.7	21.7	21.6	21.6	21.6



Test load 0.9807N(0.100)

Vickers Hardness Number

a	0.0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5
505.0	21.5	21.5	21.4	21.4	21.3	21.3	21.3	21.2	21.2	21.1
510.0	21.1	21.1	21.0	21.0	20.9	20.9	20.9	20.8	20.8	20.7
515.0	20.7	20.7	20.6	20.6	20.5	20.5	20.5	20.4	20.4	20.3
520.0	20.3	20.3	20.2	20.2	20.1	20.1	20.1	20.0	20.0	19.9
525.0	19.9	19.9	19.8	19.8	19.8	19.7	19.7	19.6	19.6	19.6
530.0	19.5	19.5	19.5	19.4	19.4	19.4	19.3	19.3	19.2	19.2
535.0	19.2	19.1	19.1	19.1	19.0	19.0	19.0	18.9	18.9	18.9
540.0	18.8	18.8	18.7	18.7	18.7	18.6	18.6	18.6	18.5	18.5
545.0	18.5	18.4	18.4	18.4	18.3	18.3	18.3	18.2	18.2	18.2
550.0	18.1	18.1	18.1	18.0	18.0	18.0	17.9	17.9	17.9	17.8
555.0	17.8	17.8	17.8	17.7	17.7	17.7	17.6	17.6	17.6	17.5
560.0	17.5	17.5	17.4	17.4	17.4	17.3	17.3	17.3	17.3	17.2
565.0	17.2	17.2	17.1	17.1	17.1	17.0	17.0	17.0	16.9	16.9
570.0	16.9	16.9	16.8	16.8	16.8	16.7	16.7	16.7	16.7	16.6
575.0	16.6	16.6	16.5	16.5	16.5	16.5	16.4	16.4	16.4	16.3
580.0	16.3	16.3	16.3	16.2	16.2	16.2	16.1	16.1	16.1	16.1
585.0	16.0	16.0	16.0	16.0	15.9	15.9	15.9	15.8	15.8	15.8
590.0	15.8	15.7	15.7	15.7	15.7	15.6	15.6	15.6	15.6	15.5
595.0	15.5	15.5	15.4	15.4	15.4	15.4	15.3	15.3	15.3	15.3
600.0	15.2	15.2	15.2	15.2	15.1	15.1	15.1	15.1	15.0	15.0
605.0	15.0	15.0	14.9	14.9	14.9	14.9	14.8	14.8	14.8	14.8
610.0	14.7	14.7	14.7	14.7	14.7	14.6	14.6	14.6	14.6	14.5
615.0	14.5	14.5	14.5	14.4	14.4	14.4	14.4	14.3	14.3	14.3
620.0	14.3	14.3	14.2	14.2	14.2	14.2	14.1	14.1	14.1	14.1
625.0	14.0	14.0	14.0	14.0	14.0	13.9	13.9	13.9	13.9	13.8
630.0	13.8	13.8	13.8	13.8	13.7	13.7	13.7	13.7	13.7	13.6
635.0	13.6	13.6	13.6	13.5	13.5	13.5	13.5	13.5	13.4	13.4
640.0	13.4	13.4	13.4	13.3	13.3	13.3	13.3	13.3	13.2	13.2
645.0	13.2	13.2	13.2	13.1	13.1	13.1	13.1	13.0	13.0	13.0
650.0	13.0	13.0	12.9	12.9	12.9	12.9	12.9	12.8	12.8	12.8
655.0	12.8	12.8	12.8	12.7	12.7	12.7	12.7	12.7	12.6	12.6
660.0	12.6	12.6	12.6	12.5	12.5	12.5	12.5	12.5	12.4	12.4
665.0	12.4	12.4	12.4	12.4	12.3	12.3	12.3	12.3	12.3	12.2
670.0	12.2	12.2	12.2	12.2	12.2	12.1	12.1	12.1	12.1	12.1
675.0	12.0	12.0	12.0	12.0	12.0	12.0	11.9	11.9	11.9	11.9
680.0	11.9	11.9	11.8	11.8	11.8	11.8	11.8	11.7	11.7	11.7
685.0	11.7	11.7	11.7	11.6	11.6	11.6	11.6	11.6	11.6	11.5
690.0	11.5	11.5	11.5	11.5	11.5	11.4	11.4	11.4	11.4	11.4
695.0	11.4	11.3	11.3	11.3	11.3	11.3	11.3	11.2	11.2	11.2
700.0	11.2	11.2	11.2	11.2	11.1	11.1	11.1	11.1	11.1	11.1
705.0	11.0	11.0	11.0	11.0	11.0	11.0	10.9	10.9	10.9	10.9
710.0	10.9	10.9	10.9	10.8	10.8	10.8	10.8	10.8	10.8	10.7
715.0	10.7	10.7	10.7	10.7	10.7	10.7	10.6	10.6	10.6	10.6
720.0	10.6	10.6	10.6	10.5	10.5	10.5	10.5	10.5	10.5	10.5
725.0	10.4	10.4	10.4	10.4	10.4	10.4	10.4	10.3	10.3	10.3



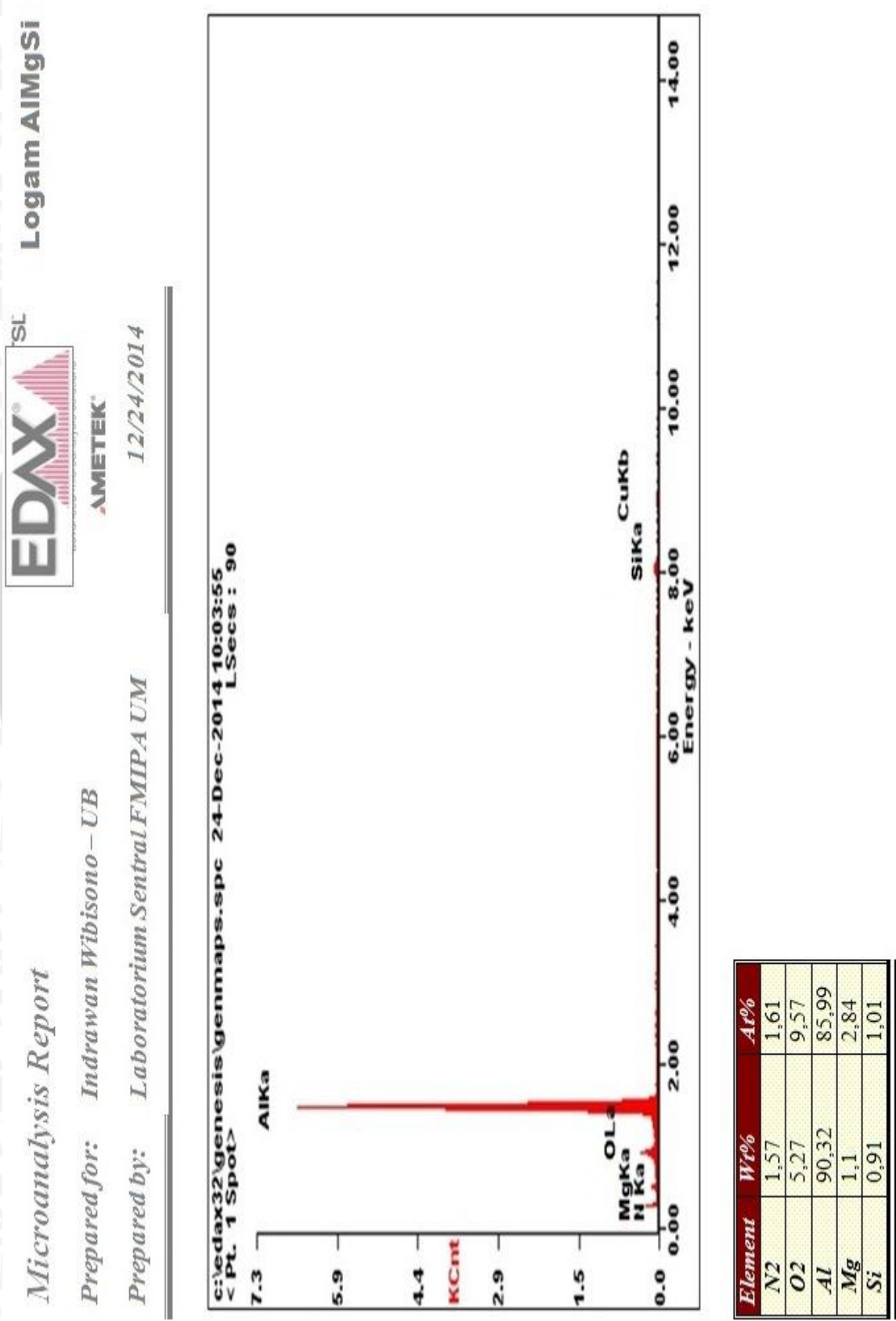
Test load 0.9807N(0.100)

Vickers Hardness Number

a	0.0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5
730.0	10.3	10.3	10.3	10.3	10.2	10.2	10.2	10.2	10.2	10.2
735.0	10.2	10.1	10.1	10.1	10.1	10.1	10.1	10.1	10.0	10.0



Lampiran 5 Sertifikat hasil pengujian komposisi kandungan spesimen



Lampiran 6 Foto kegiatan penelitian

